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Mental Health Problems in Antarctica

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YOUR attention is directed away from the Arctic regions temporarily in order to consider health problems encountered in an even more extreme environment—that of Antarctica.

For the past several years the Navy Medical Neuropsychiatric Research Unit in San Diego, Calif, has conducted studies of the emotional adjustment problems of men living and working at Antarctic scientific stations. Our experiences may suggest useful research approaches for assessing mental health problems in similar types of isolated groups in the far North.

The Antarctic continent is the most hostile environment inhabited by man. The primary objective of men going to Antarctica is scientific discovery. Research is the only significant activity on the Antarctic continent; there is as yet no important commercial or economic enterprise. Approximately 35 to 40 scientists and 250 to 300 Navy men carry out scientific projects at five US stations. This program is administered by the National Science Foundation and is logistically supported by the US Navy.

The Bureau of Medicine and Surgery of the Navy Department provide medical support for Antarctic operations, including physical and psychiatric examinations of ap-

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plicants, medical care in Antarctica, and research on the physiological and psychological effects of this environment. At most stations, Navy doctors provide medical care through the winter, collect medical and psychological research data, and serve as officers in charge.

It has long been known that varied environmental stimulation is vital to maintaining the efficiency and stability of human behavior. Many accounts of shipwreck, stranded exploration parties, remote military outposts, etc, and experimental studies of what has been called sensory or perceptual isolation have indicated that emotional and social deterioration may occur under conditions of monotonous environmental stimulation and restricted activity. Studies of the incidence of common somatic and emotional symptoms by administration of questionnaires on three occasions during the Antarctic winter were conducted during the two expeditions of the International Geophysical Year (IGY) in 1957 and 1958. In both expeditions, symptoms pertaining to sleep disturbances, depression, and irritability were found to increase during the winter months.[1] Presence of these symptoms was associated with reduced motivation and with reduced group harmony. It seemed clear from these earlier results that many individuals experienced mild to moderate psychological disturbances after several months of winter confinement.

Additional studies of symptom incidence have been conducted during the past three years. Because Antarctic living and working conditions generally have improved considerably since the IGY period, it was anticipated that the incidence of symptoms might be lower in recent expeditions. This expectation was not realized; the results of recent studies will be presented below.

Station Environments

The five US stations currently occupied year-round are McMurdo, Byrd, Palmer, Plateau, and South Pole. The studies to be described also were conducted at Eights and Hallett Stations which no longer operate through the winter months. McMurdo, the largest station with a wintering party of about 250 men, is the major staging and supply base for Navy logistic support operations. McMurdo, except for the extreme climatic conditions, enjoys many of the advantages of a typical military establishment with varied recreational facilities, including a bowling alley and even a small golf driving range, a well-equipped dispensary, a large dining hall, several barracks for sleeping quarters, and enlisted men's and officer's clubs. A nuclear reactor supplies adequate power, heat, and distilled water for a small city. At the smaller stations, conditions are strikingly different. Space and physical facilities are very limited, station members live and work in close proximity, and many normal activities and sources of stimulation typically present in larger groups are not available (Table 1).

Byrd Station is located 885 miles from McMurdo Sound on the inland ice cap at an elevation of 5,000 feet above sea level. The Station consists of prefabricated buildings placed in long tunnels 40 feet deep, roofed over with steel arches overlaid with packed snow. There are laboratory facilities for seismological, meteorological, ionospheric, auroral, and radio noise research. The Station is supplied by air during the summer months, and is maintained during the winter by about 18 Navy men; the wintering scientific party consists of about nine men. Byrd Station is the most comfortable and well-equipped of the smaller stations.

Eights Station, located near the base of the Antarctic Peninsula at about 1,400 feet above sea level, was a temporary camp consisting of portable buildings transported to the site by large aircraft. The Station operated year-round from 1963 through 1965. Living and working conditions were relatively difficult at this Station.

Hallett Station, located near McMurdo, was supplied by sea and air. Buildings are all on the surface, and the climate is less severe than that of Byrd, Eights, Plateau, or South Pole. This Station was operated jointly with New Zealand; approximately 14 Navy men and scientists made up the winter party.

Palmer Station on the Antarctic Peninsula toward South America can be reached only by ship. Four Navy men and five scientists make up the station complement. Because of its coastal location, biological stud-

ies are emphasized. Climatic conditions are less extreme at Palmer than at other stations.

Plateau Station, established in 1966, consists of five portable vans linked together. The Station accommodates four Navy personnel and four scientists who conduct studies in aurora, airglow, geomagnetism, very low frequency (VLF) radio propagation, and radiation climatology. The Station is located in an inaccessible region high on the polar plateau between the geographic south pole and Queen Maud Land at an altitude of almost 12,000 feet above sea level. A low temperature of −116.4 F was recorded at Plateau Station last year, and it is expected that temperatures may fall as low as the world's record of −126.9 F established at Russia's Vostok Station. Thus, Plateau and Vostok Stations probably share the distinction of having the most extreme environmental conditions of any inhabited spots on the earth.

The South Pole Station is at the geographical south pole at an elevation of approximately 9,200 feet above sea level. The mean annual temperature at the South Pole is 57 F and during the winter months the extremely low temperature of −110 F has been recorded. South Pole Station typically has 13 Navy men and seven scientists and meteorologists in the winter party. Scientific programs are carried out in aurora, airglow, ionospheric studies, meteorology and seismology. This year for the first time the National Science Foundation is supporting physiological studies at the South Pole. A research team from the University of Oklahoma Medical School is collecting electroencephalograms and blood measures which will be related to emotional and behavioral data.

During the summer months, that is, approximately November to February, personnel at all stations are heavily burdened with construction, repairs, and storage of supplies for the long winter ahead. These tasks demand hard work and the ability to withstand long hours, little sleep, very cold temperatures, and, at some locations, high altitude. During the six to eights months of most severe weather and darkness, station personnel are forced indoors and activities are very limited. The most critical aspect of life at any small station is the fact that after the onset of winter there is no possibility of evacuation or of obtaining outside help. Contact with the outside world is restricted to radio communication, and at times even radio communication is not possible. Because men are confined to the physical boundaries of the camp, another important feature of station life is the lack of privacy and the impossibility of getting away from one's associates.

During the past year, emergency medical evacuations were accomplished from Byrd Station on Sept 13 and from McMurdo on June 6. As air navigational and landing control techniques improve, the small interior stations may become more accessible during the winter months. Flights later than February and before October are at present uncertain and extremely hazardous, however.

Group Composition

Antarctic station groups typically are composed of a wide variety of occupational and scientific specialists. Even the smallest

Table 1.—*Station Characteristics*

	Byrd	South Pole	Palmer	Plateau	Eights*	Hallett†
Location:						
Terrain	inland ice	inland ice	bedrock	inland ice	inland ice	glacial moraine
Latitude	79°59′S	90°S	64°45′S	79°30′S	75°15′S	72°19′S
Air distance from McMurdo	885 miles	820 miles	2,360 miles	1,350 miles	1,525 miles	380 miles
Feet above sea level	4,971	9,184	25	11,890	1,380	16
Method of Supply:	air	air	sea	air	air	air, sea
Number of buildings:	15	11	2	8	11	11
Mean annual temperature:	−19 F	−57 F	+20 F	—	−13 F	+4 F
No. of winter personnel (approximate):						
Civilian	9	7	5	4	5	5
Military	18	13	4	4	6	9

* Discontinued operation after 1965; reoccupation is planned for 1968 and 1969.
† Jointly operated by the United States and New Zealand; discontinued year-round operation after 1964.

Table 2.—*Composition of Station Groups by Occupational Specialties

Occupational Specialty	Byrd	South Pole	Palmer	Plateau	Eights	Hallett
Navy:						
Medical officer	1	1	—	1	—	1
Hospital corpsman	1	1	1	—	1	1
Radioman	2	2	1	—	1	2
Cook	1	1	1	1	1	1
Electronics technician	1	1	—	1	1	1
Electrician	2	2	—	—	1	1
Mechanic	2	1	1	1	1	1
Carpenter	3	1	—	—	—	—
Plumber	2	1	—	—	—	1
Equipment operator	2	1	—	—	—	—
Storekeeper	1	1	—	—	—	—
Civilian:						
Meteorology	3	3	—	—	1	3†
Scientists	6	4	5	4	4	2

* Assignments shown represent average or typical complements and do not include exchange scientists from other countries.

† Navy aerographers or New Zealand meteorologists; station was jointly operated by the United States and New Zealand.

station must have at least one man in each of the following occupational specialities: medicine, radio communications, electronics or electrical repair, heavy equipment or engine operation and repair, and cooking. Other occupational specialties may be included at various stations depending upon construction or scientific projects to be carried out, equipment to be operated or maintained, and available space (Table 2).

Except for radiomen and meteorologists, only one specialist from each occupation is typically present. Each man has a particular task which makes a unique contribution to the group's mission. Group members usually are required to assume duties outside their occupational specialties, including a share of the general housekeeping chores.

Because of the diversity of occupations, social and educational backgrounds of group members vary considerably, and psychological differences tend to be associated with these social background differences. For example, Navy cooks, mechanics, and equipment operators differ from scientists and naval officers on a wide range of cultural background and personality characteristics. In these small, closed groups certain differences tend to have adverse effects upon communication, teamwork, and accomplishment.

General Medical Problems

The general health problems encountered in the Antarctic can be illustrated by the following statistical data. The high mortality in Antarctica during the early "heroic era" has shown a dramatic decrease during recent years. For the period from 1898 through 1958, Beltramino calculated a mortality of 26.7/1,000 for members of wintering-over parties.[2] Hedblom reported an average death rate over five years (1955-1959) of 5.0/1,000 for the Antarctic compared with 1.8/1,000 for the entire Navy.[3] During 1961 to 1962, the mortality for Antarctica was about the same as that for the Navy as a whole (1.5/1,000). Seven accidental deaths within one month in 1966 again called attention to the risks of this hostile and violent environment. The chief causes of death or injury in the Antarctic have been aircraft and motor vehicle accidents, drowning, burns, exposure to cold, and falls.

Data compiled by the Medical Department of the Naval Support Force, Antarctica, have indicated that during the two-year period, 1961 to 1962, the number of dispensary visits by Antarctic personnel averaged about eight for each man annually. South Pole Station with the most severe climatic and living conditions had the highest incidence of dispensary visits both years. Civilians had a slightly lower rate than Navy men (7 vs 9).

Hedblom, in the previously cited article, reported that for the five-year period, 1956 to 1960, Navy men serving aboard ship in Antarctic waters had one third as many total illnesses of all types as Navy men serving at Antarctic stations, but only one fifth as

Table 3.—*Emotional Symptoms Reported by Navy and Civilian Subgroups at Two Time Periods**

	Navy		Civilian	
	Early	Late	Early	Late
Insomnia:				
Difficulty falling asleep	53	74	51	48
Waking up at night	42	64	27	31
Feeling tired during the day	69	72	57	62
Depression:				
Feeling blue	66	80	56	56
Feeling lonely	63	68	46	44
Anxiety:				
Feeling nervous and tense	43	59	38	52
Inability to concentrate	32	48	38	58
Feeling uneasy or worried	46	48	31	42
Hostility:				
Feeling easily annoyed or irritated	64	87	66	79
Feeling critical of others	53	76	74	90
No. of cases	114	111	61	52

* Percentages of individuals reporting presence of symptom at early winter (March) and late winter (Sept).

many injuries and one seventh as many psychiatric conditions.

For the entire Navy during the period 1961 to 1962, the hospitalization rate for psychiatric disorders was approximately 1/100 each year. For all Navy personnel serving in Antarctica during the same period, the incidence of diagnosed psychiatric disorders was approximately 3/100 each year, although most of these cases probably were seen on an outpatient basis only. In summary, while the health of Antarctic personnel is generally good, the risk of injury or psychiatric difficulties is a little higher in Antarctica for Navy men than it is elsewhere.

Measurement of Emotional Symptoms

Because the incidence of gross psychiatric disturbances is very low, however, such infrequent events could not provide a useful criterion for evaluating emotional adaptation to this environment. Techniques were needed which could measure the emotional responses of each individual to Antarctic station life. Two types of measures were developed over a period of several years. The first was a score reflecting the "emotional stability" of each individual at each station. This measure was derived from ratings made by station leaders and from evaluations made by associates. These data were gathered twice during the year.

A second measure of emotional reactions to the station environment was obtained by means of a symptom questionnaire administered twice during the year, at the beginning of winter and again near the end of winter. The questionnaire included ten common symptoms which had shown high prevalence or significant increase during the earlier IGY expeditions. The symptoms pertained to insomnia, anxiety, depression, and irritability. Data were obtained from ten station groups in three expeditions (1964 to 1966). Responses were given on a four-point scale: no complaint, slight, moderate, and severe. The measure of symptom incidence used for comparisons was the percent of individuals reporting some degree of complaint.

Emotional changes in Navy and civilian personnel are compared in Table 3. Navy personnel showed higher incidences of insomnia and depression than did civilians at both time periods and much larger increases in both types of symptoms during the winter period. Civilian personnel showed little or no increase in sleep disturbances or depression. Navy and civilian participants did not differ appreciably in anxiety symptoms at either time period, but both groups reported moderate increases in these symptoms during the winter. Feelings of irritability or hostility were very prevalent late in the year for both Navy and civilian groups, and both groups showed moderate increases in these symptoms from early to late winter. Overall, Navy personnel evidence more symptomatic distress than did the civilian scientists and technicians, suggesting that occupation or work role was a significant factor in determining the amount of emotional stress experienced in this environment (Table 3).

The "Other Stations" category included responses from personnel at Hallett, Eights, and Palmer Stations which were smaller in size and generally provided less complete data than did either Byrd or South Pole. The results indicated that personnel at the smallest stations reported more anxiety and depression at both time periods than did Byrd and South Pole, but less sleep disturbance. Hostility symptoms were more prevalent early in the winter at the smallest sta-

Table 4.—*Emotional Symptoms Reported by Station Groups at Two Time Periods

	Byrd		South Pole		Other Stations	
	Early	Late	Early	Late	Early	Late
Insomnia						
Difficulty falling asleep	47	63	69	74	51	59
Waking up at night	35	54	47	58	24	44
Feeling tired during the day	65	70	57	69	76	67
Depression:						
Feeling blue	62	76	63	64	68	81
Feeling lonely	60	61	48	49	65	81
Anxiety:						
Feeling nervous and tense	37	53	38	57	56	57
Inability to concentrate	36	46	35	48	35	62
Feeling uneasy or worried	39	43	33	42	57	62
Hostility:						
Feeling easily annoyed or irritated	60	88	57	83	86	81
Feeling critical of others	55	76	60	81	72	91
No. of cases	83	76	52	52	32	32

* Percentages of individuals reporting presence of symptom at early winter (March) and late winter (Sept).

tions, but were no more prevalent than at Byrd or South Pole at the end of winter. Results for Byrd Station, South Pole Station, and other small stations combined are compared in Table 4.

We have gathered other data pertaining to motivational changes which point to the same conclusions: the man's job has an important bearing upon the risk of developing emotional and motivational problems—radio communications personnel and medical personnel appear particularly vulnerable to emotional and motivational problems—radio operators, because of their isolation from other members of the station much of the time; and hospital corpsmen, because of little demand for medical services through the long winter period.

The incidences of symptoms at Byrd and South Pole Stations generally were very similar. Symptoms at the smallest stations, that is, Hallett, Eights, and Palmer, tended to be more frequent than at Byrd or South Pole. Presumably, participants experienced more difficulty adapting to the close quarters and very limited facilities typical of the smallest stations.

After developing techniques for measuring emotional difficulties at Antarctic stations, it was logical to ask the question: "Can emotional adjustment in Antarctica be predicted from knowledge about the individual gathered during the psychiatric screening prior to deployment to Antarctica?" Personal history items, such as age, education, years of occupational experience, marital status, region of residence, and family background, as well as personality test scores, personality ratings by psychologists and psychiatrists, and data pertaining to the individual's hobbies or recreational interests, were correlated with emotional-stability ratings and symptom measures gathered in Antarctica. The most striking aspect of the correlational results were the differences in the relationship between screening information and emotional-adjustment measures for the different occupational groups. The psychological needs and characteristics which were predictive of good emotional adjustment for Navy men were not necessarily favorable for the civilian personnel.

Ratings by psychologists and psychiatrists on negative personality traits, such as aggressive, excitable, impulsive, and hostile, and ratings on positive traits, such as emotional control, conforming, and tactful, tended to correlate in the expected direction with emotional adjustment in Antarctica for both Navy and civilian groups.

Specific hobbies and recreational interests which were predictive of emotional adjustment varied for the Navy and civilian groups, but emotionally stable individuals from both groups tended to have neutral feelings toward many popular recreational activities, that is, neither strongly liked nor disliked popular music, western or country style music, movies, photography, card playing, and so on. It was evident that the emotionally well-adjusted Antarctic scientist was indifferent toward many common recreational activities.

Differences in emotional responses to the Antarctic environment probably can be largely attributed to changes in self-esteem and group status which in turn are related to the perceived importance of one's job. This relationship is strongly suggested by the fact that scores on a scale reflecting feelings of "usefulness" remained unchanged for civilian personnel over the Antarctic winter, but such scores showed a significant reduction for Navy men. Furthermore, among Navy men, those who reported most reduction in feelings of usefulness also reported most emotional symptomatology near the end of winter.

Another factor which probably affected differences in emotional response was the relative dependence of Navy men upon certain immediate rewards: approval of associates and supervisors, favorable results of promotional exams, orders to next duty station, etc. The scientists expected professional rewards or satisfactions from their research labors only after considerable delay. Indirect support for this notion also was provided by the somewhat surprising fact that high levels of expressed motivation prior to deployment were *negatively* correlated with emotional adjustment in the Antarctic for Navy men; this relationship did not hold for the civilians. Apparently Navy men with the most favorable and perhaps unrealistic expectations towards the rewards of Antarctic service were most likely to be disappointed in the experience.

Similarly, Navy men expressing high achievement needs in a screening test were more prone to develop emotional difficulties than others. Because opportunities for work and educational achievement are quite limited in the Antarctic setting, particularly for Navy men, it is not surprising that frustration or disappointment should be more apt to occur among those who strongly value accomplishment.

A related observation that individuals at small Antarctic stations who express strong interest in hobbies and avocational activities have more emotional problems than those who have few activity preferences also lends support to the idea that environmental restrictions are important insofar as they affect the satisfaction of important personal needs. At the large Antarctic station, McMurdo, where participation in many more recreational activites was possible, there was a slightly positive relationship between activity needs and adjustment ratings for Navy men.

Finally, there is consistent evidence that different work roles require different personality and social characteristics. For example, although it is important in the Antarctic setting that cooks be sociable and gregarious, these traits would be inappropriate for radio operators. The adverse or positive effects of such personality characteristics as high achievement needs or strong affectional needs are enhanced by specific role requirements and by environmental limitations.

Summary

Mental health problems are of special concern at small Antarctic stations because of the extreme environmental conditions and because of the complete isolation from the outside world during the winter months. Emotional symptoms, such as insomnia, anxiety, depression, and irritability, were common and tended to increase during the winter months. Such changes in emotional adjustment were predictable to some degree from psychiatric screening information gathered prior to deployment to the Antarctic stations. Emotional adjustment depends importantly upon the man's specific job at the station and upon the appropriateness of his psychological needs, personality traits, and recreational interests for his particular role.

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13. ABSTRACT

Health problems are of special concern at small Antarctic stations because of the extreme environmental conditions and because of complete isolation from the outside world during the winter months. Incidences of common symptoms, reflecting insomnia, anxiety, depression, and hostility increased significantly during the winter months in three recent Antarctic expeditions. These results confirmed earlier findings obtained during the IGY period. A number of personal history and personality variables were found to correlate significantly with two criteria of emotional adjustment: (1) ratings of emotional stability by supervisors and peers at Antarctic stations, and (2) symptom scores from a questionnaire filled out twice during the winter. Relationships of psychiatric screening information to the emotional adjustment criteria varied with occupational group, particular criterion measure, and time of year.

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